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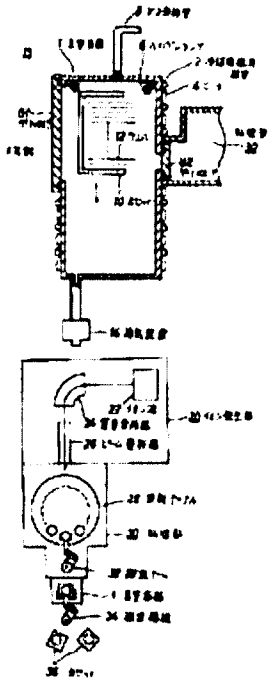
(54) EXHAUSTING METHOD

(57)Abstract:
PURPOSE: To remove any airtight vessel deposit thereby enabling the vessel exhaust to be released in the atmosphere within a short time by a method wherein the inner wall of the airtight vessel is heated at the temperature exceeding the water vaporizing temperature by a heating means before or while said vessel is released in the atmosphere.
CONSTITUTION: A cassette 36 containing semiconductor wafers not yet processed is carried in a vessel 1 and then an atmospheric side gate valve G1 is closed so as to exhaust the vacuum vessel 1 down to specific vacuum degree using an exhaust system 14. Simultaneously, semiconductor wafers 12 are heated at specific temperature e.g. 140° C using heaters 4 and halogen lamps 6 so as to rapidly vaporize the water content deposited in the atmospheric air as well as to maintain the heated state for specific hours. Later, the semiconductor wafers 12 are cooled down to specific temperature by circulating a cooling medium in a piping 2 for cooling circulation. Through these procedures, the airtight vessel deposit can be removed thereby enabling the airtight vessel exhaust to be released in the atmosphere within a short time.



CLAIMS

[Claim(s)]
[Claim 1]An exhaust method comprising:
A process of heating a tight container wall to a predetermined temperature before opening an opening and closing door and releasing a tight container at least to the atmosphere.
Under air release and the above-mentioned opening and closing door are closed for a tight container, and they are predetermined time in evacuation, and the process of maintaining the above-mentioned tight container to predetermined cooking temperature at least, about inside of a tight container.
Next, a process of cooling the above-mentioned tight container to a predetermined temperature.

[Claim 2]An exhaust method comprising:
A process of facing a tight container exhausting after releasing to the atmosphere for a long time, and heating a tight container from exhaust air operation start before to a predetermined temperature at least.
An opening and closing door is closed and they are predetermined time while exhausting the inside of a tight container, and the process of maintaining a tight container to predetermined cooking temperature at least.
Next, a process of cooling a tight container to a predetermined temperature.

[Claim 3]An exhaust method comprising:
A process of heating a tight container to a predetermined temperature at least while releasing a tight container to the atmosphere.
An opening and closing door is closed and they are predetermined time while exhausting the inside of a tight container, and the process of maintaining a tight container to predetermined cooking temperature at least.
Next, a process of cooling a tight container to a predetermined temperature.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention relates to an exhaust method.
[0002]
[Description of the Prior Art]In a semiconductor wafer manufacturing process, conventionally A CVD system, an epitaxial apparatus, Many pieces of equipment which performs the processing which makes a vacua a processed object, for example, a semiconductor wafer, for example, membrane formation, an ion implantation, etc., such as film deposition systems and ion implantation equipment, such as an oxide film forming device and dispersion equipment, a dry etching system, and a sputtering system, is used. these vacuum processors -- a semiconductor wafer -- many -- there are a batch type processed at once several sheets and single wafer processing processed for every sheet. The vacuum housing is manufactured by stainless steel or the aluminum containing alloy, and is performing exhaust air from atmospheric pressure, using a turbo molecular pump and a rotary pump as the exhaust.
[0003]When exhausting by sealing a container from the state which released the vacuum housing to atmospheric pressure, in order to obtain a high vacuum degree, after becoming a predetermined pressure after an exhaust air start, with the container which consists of an elevated temperature called fixed time baking powder in a vacuum housing, for example, an aluminum containing alloy, the method of performing heating degassing treatment at 140 ** is performed. When returning the inside of a vacuum housing to atmospheric pressure from a vacua, introduce dry nitrogen gas and dry air into a container, and a container is made to fill with the gaseous atmosphere, or, In releasing some containers by exchange of the sample etc. which are inserted in the inside of a container, treatment which dry nitrogen gas and dry air emit from a release opening was carried out, and it has coped with it so that the moisture in the atmosphere cannot advance easily into a vacuum housing.
[0004]
[Problem to be solved by the invention]In the technology which performs and carries out evacuation of the baking powder, in order for baking powder to take a long time, it had the improving point that it was inefficient. In the method of emitting dry nitrogen gas from the release opening of a vacuum housing, when releasing a vacuum housing to the atmosphere. Even if it emitted dry nitrogen gas so much, when released for 1 minute, neither the atmospheric diffusion or inflow to a vacuum housing, nor contamination was avoided, but there was predetermined time, for example, the atmospheric problem that moisture will adhere in a vacuum housing.
[0005]In the semiconductor processor which performs vacuum treating which was explained above, when a vacuum housing is returned to atmospheric pressure when carrying in a processed object to a vacuum housing, and a vacuum housing wall contacts the atmosphere, adsorption of the gas molecule which makes the moisture to a vacuum housing wall surface the inside of a short time with a subject extremely takes place. Within the vacuum housing in which rough exhaust air was performed by the room temperature state, condensation and dew condensation of the moisture in the atmosphere adhering to a vacuum housing wall occur.
[0006]In the early exhaust air process, it evaporates gradually and reduction in a pressure is barred as main remains gases, and the moisture which adsorbed or adhered to such a container wall lengthens the time required which reaches a predetermined degree of vacuum, and has become a factor which reduces processing efficiency. When especially the humidity of an external atmosphere is high, or when the vacuum housing is cooled, generating of dew condensation is remarkable and vacuum suction has taken time.
[0007]This invention was made in order to improve the above-mentioned fault, and it provides the exhaust method which can perform exhaust air of the tight container which removes a tight container affix and is released by the atmosphere in a short time.
[0008]
[Means for solving problem]The process of heating a tight container wall to a predetermined temperature before the 1st invention method's opening an opening and closing door and releasing a tight container at least to the atmosphere, An exhaust method which closes under air release and the above-mentioned

opening and closing door for a tight container, and is characterized by becoming the predetermined time in evacuation, the process of maintaining the above-mentioned tight container to predetermined cooking temperature at least, and the next from the process cooled to a predetermined temperature in the above-mentioned tight container about the inside of a tight container.

[0009]The process of the 2nd invention method facing a tight container exhausting after releasing to the atmosphere for a long time, and heating a tight container from exhaust air operation start before to a predetermined temperature at least, An exhaust method closing an opening and closing door and consisting of predetermined time while exhausting the inside of a tight container, a process of maintaining a tight container to predetermined cooking temperature at least, and a process of cooling a tight container to a predetermined temperature at the next.

[0010]The process to which the 3rd invention method heats a tight container to a predetermined temperature at least while releasing a tight container to the atmosphere, An exhaust method closing an opening and closing door and consisting of predetermined time while exhausting the inside of a tight container, a process of maintaining a tight container to predetermined cooking temperature at least, and a process of cooling a tight container to a predetermined temperature at the next.

[0011]

[Function]In the vacuum devices in which this invention method consists of the heating method and cooling method which are provided in a tight container and this tight container, and an exhausting means connected to said tight container, Before air release and during air release, since a tight container wall is heated by a heating method beyond the evaporation temperature of water, adhesion in the tight container wall of moisture has few tight containers. Evacuation of the tight container is carried out and there are little initial period of decompression, and the condensation and dew condensation which originate in decompression of moisture since it is heating like the above. The inside of a tight container can acquire a good high vacuum after predetermined time by cooling a tight container and a processed object to temperature with little degasifying by said cooling method.

[0012]

[Working example]The composition of ion implantation equipment is first explained concretely with reference to Drawings about one or less embodiment and one embodiment which applied the exhaust method of this invention to the load-locks part of ion implantation equipment. the tight container 1, for example, the vacuum housing, which are shown in drawing 1. It is the cube, for example, the length, the width, and the about 25x25x50-cm-high thing which were made into welding structure according to construction material, for example, a stainless steel, In a container peripheral wall, it is for example, an outside diameter as a cooling method. The piping 2 for refrigerant circulation which consists of about 6-mm copper pipes is wound spirally, The above-mentioned vacuum housing 1 in order to improve heat conduction, and the both ends of the above-mentioned piping 2 are connected to the equipment for refrigerant temperature adjustment, for example, the chiller etc., etc. which are not illustrated, and the refrigerant is constituted so that circulation feed may be possible. [this piping 2] [stick for example,] [low] The heater 4 which is a heating portion which consists of sheath heaters sticks to the above-mentioned vacuum housing 1 as a heating method of the above-mentioned vacuum housing [the spiral above-mentioned piping 2 for refrigerant circulation and by turns], and it is wound spirally, and is connected to the power supply controlling device for heating which the exterior does not illustrate. The halogen lamp 6 as a heating method of a processed object, for example, a semiconductor wafer, is formed in the inside of the above-mentioned vacuum housing 1.

[0013]It is installed, in order that it may be the above-mentioned vacuum housing 1, for example, the gate valve G1 and G2 may carry out taking-out ON of a processed object, for example, the semiconductor wafer, to the both side surfaces which counter.

[0014]The gas supply line 8 which supplies nitrogen gas is formed in the upper part in the above-mentioned vacuum housing 1 from the gas supply source which is not illustrated.

[0015]In order to exhaust the vacuum housing 1 at the pars basilaris ossis occipitalis of said vacuum housing 1, it is capability at a rotary pump, for example with capability 250-l. a part for /and a turbo

molecular pump. The exhaust 14 constituted by the second in 300 l. /is connected, With the composition like ****, the load-locks part 15 is formed for decompressing from a degree of vacuum, for example, 10^{-6}Torr, to 10^{-9}Torr.

[0016]Drawing 2 is an explanatory view showing the entire configuration of ion implantation equipment. That is, the ion generating section 20 is constituted so that the ion source 22, the mass spectrograph 24, and beam plastic surgery machine 26 grade may be provided one by one in a vacuum housing in an ion passage and it may be held by the evacuation means which is not illustrated at a vacua. In the treating part 30 combined so that it might become the same vacuum atmosphere as this ion generating section 20. The rotating table 28 which rotates at the speed which held the processed object, for example, the semiconductor wafer of two or more sheets, and was defined beforehand, and the robot provided with the transportation arm 32 which carries out carrying in/out automatically by the program which was able to provide the processed object in this rotating table 28 beforehand are formed.

[0017]The cassette 36 34 which was formed out of the above-mentioned container 1, and accommodated two or more processed objects before processing, for example, the conveyer style which carries out carrying in/out of the wafer carrier automatically by the program in which it was beforehand provided in the above-mentioned vacuum housing 2, is formed. Ion implantation equipment is constituted like the above.

[0018]Next, an example of the exhaust method of the above-mentioned equipment is described.

[0019]The cassette 10 by which the processed processed object of two or more sheets, for example, a semiconductor wafer, was stored is laid in the vacuum housing 1, and the case where the above-mentioned semiconductor wafer is taken out with the cassette 10 is explained below. In order to prevent the moisture in the atmosphere adhering to the wall of the vacuum housing 1, the inside of the vacuum housing 1 is heated to a predetermined temperature, for example, 140 **, for [predetermined time, for example, ,] 5 minutes by sending current through the heater 4 by a vacua. Then, after introducing until it reaches atmospheric pressure from the gas supply line 8 in nitrogen gas in the vacuum housing 1, and reaching atmospheric pressure, in order to take out the above-mentioned cassette 10, the atmosphere side gate valve G1 is opened. Next, by making the conveyer style 34 drive, the cassette 10 containing the processed wafer in the vacuum housing 1 is taken out, and the cassette 36 containing the semiconductor wafer before processing is carried in in the vacuum housing 1. That is, the cassette 10 is replaced. Then, the gate valve G1 by the side of the atmosphere is closed, and the inside of the vacuum housing 1 is exhausted to a predetermined degree of vacuum with the exhaust 20. The moisture which adhered in [, such as an internal-surface top of the vacuum housing 1,] the atmosphere by having been exposed to the atmosphere simultaneously with this exhaust air processing is made to evaporate promptly, In order to promote exhaust air processing, by operating the halogen lamp 6 formed in the heater 4 formed in the periphery of the vacuum housing 1, and the vacuum housing 1, the semiconductor wafer which is a processed object heats the one above-mentioned wall to a predetermined temperature, for example, 140 **, and holds a heated state during predetermined time, for example, 5 minutes. Then, the piping 2 for cooling circulation is made to circulate through a cooling medium, and it cools from speed, a part for for example, 50 **/, to a predetermined temperature, for example, 20 **, by a part for 100 **/.

[0020]Next, after inside of the vacuum housing 1 reaches a predetermined degree of vacuum, the gate valve G2 by the side of the treating part 30 is opened, and a wafer in the vacuum housing 1 is conveyed to a specified position on the rotating table 28 by the transportation arm 32. **** of the rotating table 28 -- if specified number installation of the wafer is carried out at a position defined beforehand, the rotating table 28 concerned will stand up vertically, ion from the ion generating section 20 will be accelerated, and ion implantation treatment will be performed to each wafer in scan.

[0021]Relation between lapsed time and a pressure is shown in drawing 5 about three examples which performed exhaust air processing from the above-mentioned atmospheric pressure. In drawing 5, changing curve ** is what carried out exhaust air processing of the vacuum housing 1 by the embodiment method of this invention, and is returned to atmospheric pressure from a vacua, and it is inside of the vacuum

housing 1 for after [an evacuation start] 5 minutes. A 140 ** heated state is maintained and the characteristic of pressure variation at the time of performing cooling and returning the vacuum housing 1 to a room temperature after that, is shown. It shows the characteristic of pressure variation at the time of always keeping the vacuum housing 1 at 20 ** which is a room temperature until it starts evacuation, after changing curve **'s returning the vacuum housing 1 to atmospheric pressure from a vacua with the conventional exhaust method. After it keeps a room temperature state being the same as that of changing curve ** for 20 minutes after an evacuation start and changing curve ** holds the vacuum housing 1 for 5 minutes with 1 140 ** of vacuum housings after that, it shows the characteristic of pressure variation at the time of performing cooling.

[0022]By a conventional method, it has taken about 1000 minutes to reach reaching a degree of vacuum of 10^{-7}Torr from atmospheric pressure for about 40 minutes at 10^{-8}Torr so that clearly from changing curve [of drawing 5] **, but. In this invention, compared with a method of of abbreviation 9 minutes and, about 40 minutes, and the former, exhaust air processing time is shortened by 1/25 from one fourth so that clearly also from changing curve **. [time of concentration / each / degree-of-vacuum] In the above-mentioned embodiment equipment, the vacuum housing 1 may be covered with covering as a heating method and a cooling method, and a steam of a heat transfer medium, for example, a hot wind and a cooling medium, for example, liquid nitrogen, may be introduced into inside of this covering. After heating the vacuum housing 1 and a processed object in exhaust air down stream processing and removing an internal-surface affix of the vacuum housing 1, From the gas supply line 8, specified quantity introduction of the argon gas of inactive gas, dry gas, for example, nitrogen, which were cooled, for example, may be carried out at the vacuum housing 1, and said vacuum housing 1 and a processed object may be cooled.

[0023]When the vacuum housing 1 is neglected to atmospheric pressure by a long time, for example, one-day or more room temperature state, even if it is, A heated state is used from just before an exhaust air start (for example, 5 quota) during time predetermined [after an exhaust air start], for example, 5 minutes, an internal-surface affix is removed, and there is the shortening effect of exhaust air processing time like the above by cooling the vacuum housing 1 and a processed object after that.

[0024]A dawn method from two embodiments is not a method of using it only about the above-mentioned embodiment equipment but the method of using it also about the 2nd embodiment equipment explained below.

[0025]One embodiment which applied evacuation method equipment of this invention to a single-wafer-processing load-locks part is concretely described with reference to drawing 3. In order to improve heat responsibility to heating cooling of a vacuum housing wall, the vacuum housing 1 is made into dual structure of the outside vacuum housing 1A and the inner vacuum housing 1B. Since an atmospheric pressure is mainly taken charge of, the outside vacuum housing 1A has been designed and manufactured in good health on a machine structure target, and a degree of vacuum of the inside is constituted so that it may be set to $1x10^{-4}$Torr from middle with a degree of vacuum of the inner vacuum housing 1B, for example, 1Torr, and can exhaust.

[0026]The inner vacuum housing 1B is formed inside the outside vacuum housing 1A. This inner vacuum housing 1B is designed and manufactured so that thermal conductivity may become high, and the same heating method 4 and cooling method 2 as Embodiment 1 are provided in that peripheral wall.

[0027]The exhaust path 58 for exhausting the vacuum housing 1B in the lower part of said inner vacuum housing 1B penetrates the outside vacuum housing 1A, and is established, The exhaust, for example, for example, a part for rotary pump capability 250-l./and turbo molecular pump capability, which are not illustrated A second is connected in 300 l. /, and it is constituted so that it may be possible to decompress from a vacuum, for example, 10^{-6}Torr, to 10^{-9}Torr.

[0028]Since the gate valve G1 and G2 are the taking-out ON of a processed object, for example, a semiconductor wafer, it is installed in the both side surfaces of said vacuum housing.

[0029]The processed object 12, for example, a semiconductor wafer, is laid in said vacuum housing 1B, for example, the susceptor 40 which consists of ceramic substrates is formed. The section structure of this

susceptor 40 is shown in drawing 4. The susceptor 40 comprises a heating heater portion which consists of the ceramic heater 44 laid underground the insulating ceramics 42 and in these ceramics 42, and a plate part which consists of the upper plate 46 which holds this and has refrigerant circulation structure, and the lower plate 48. After installing the refrigerant introducing port 52 and the outlet 54 in this plate part, the refrigerant sent out from the equipment for refrigerant temperature control which is not illustrated entering from the refrigerant introducing port 52, circulating through the refrigerant circulation slot 50 on the spiral shape and cooling the susceptor 40, it discharges from the refrigerant outlet 54.
[0030]The vacuum devices of Embodiment 2 explaining this invention method are constituted as mentioned above, and since an evacuation method is the same as that of explanation of said Embodiment 1, explanation is omitted.
[0031]In the above-mentioned embodiment, the heating heater portion of a susceptor does not necessarily need to be a charge of a ceramic material, and structure which embedded a sheath heater etc. to a metal plate may be sufficient as it. Or it may heat with the halogen lamp 6 which is the heating method installed in an inside.
[0032]Since the boiling point of water falls to 59 ** at the time of degree-of-vacuum 1Torr, if cooking temperature of said vacuum housing 1 under decompression and a processed object is not less than 59 ** at the time for example, of 1Torr, it will act good.
[0033]The above-mentioned embodiment is explanation of one embodiment of this invention method, and do not restrict for applying to ion implantation equipment, but not necessarily A thermal treatment equipment and CVD systems, such as oxidation and diffusion, If a vacuum housing, low-pressure containers, or those load locks chamber, such as an etching device, etc. are the exhaust methods of a tight container, applying to any is also possible.
[0034]
[Effect of the Invention]As explained above, it becomes possible [the tight container which carried out air release according to the exhaust method of this invention, and the affix which adhered to the container internal surface at least] to exhaust for a short time.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]Drawing of longitudinal section of the load locks concerning Embodiment 1 for explaining this invention method.
[Drawing 2]The approximate account figure of the ion implantation equipment which applied Embodiment 1.
[Drawing 3]The sectional view of the load locks concerning Embodiment 2 of this invention method.
[Drawing 4]The structure explanatory view of a susceptor used for drawing 3.

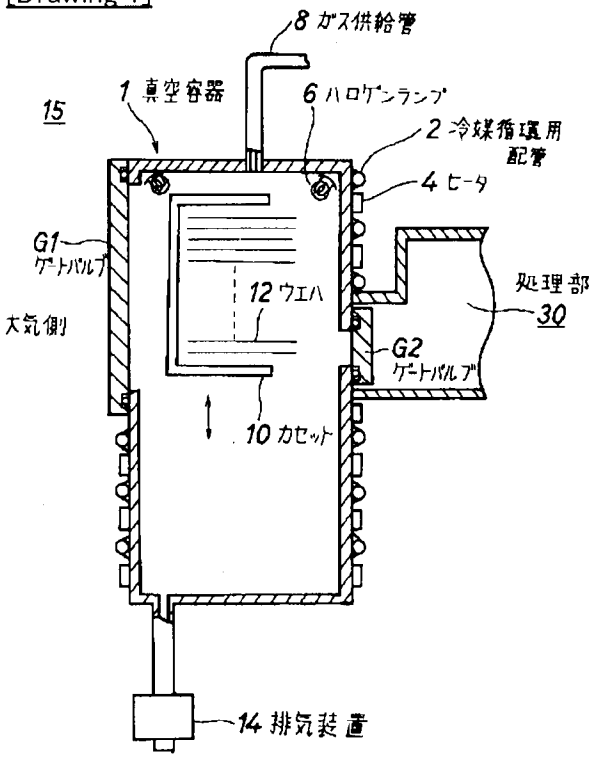
[Drawing 5]The exhaust characteristic figure of the vacuum housing used for drawing 1.

[Explanations of letters or numerals]

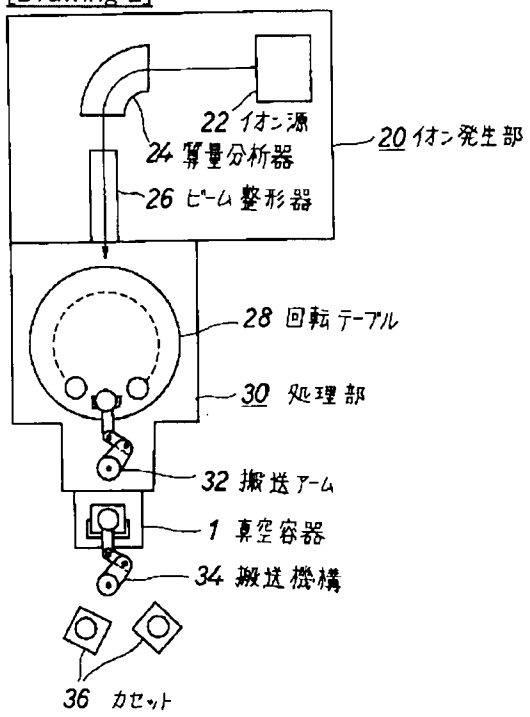
1 ..... Vacuum devices
2 ..... Pipe for refrigerant circulation
4 ..... Heater
6 ..... Halogen lamp
8 ..... Gas supply line
10 ..... Cassette
12 ..... Semiconductor wafer
14 ..... Exhaust
20 ..... Ion generating section
22 ..... Ion source
24 ..... Mass spectrograph
26 ..... Beam plastic surgery machine
28 ..... Rotating table
30 ..... Treating part
32 ..... Transportation arm
34 ..... Conveyer style
36 ..... Cassette
40 ..... Susceptor
42 ..... Insulating ceramics
44 ..... Ceramic heater
46 ..... Upper plate
48 ..... Lower plate
50 ..... Refrigerant circulation slot
52 ..... Refrigerant introducing port
54 ..... Refrigerant outlet
56 ..... Electric power lead for ZASEPUTA heating
58 ..... Exhaust path
G1 ..... The atmosphere side gate valve
G2 ..... The treating part side gate valve
1A ..... Outside vacuum housing
1B ..... Inside vacuum housing

DRAWINGS

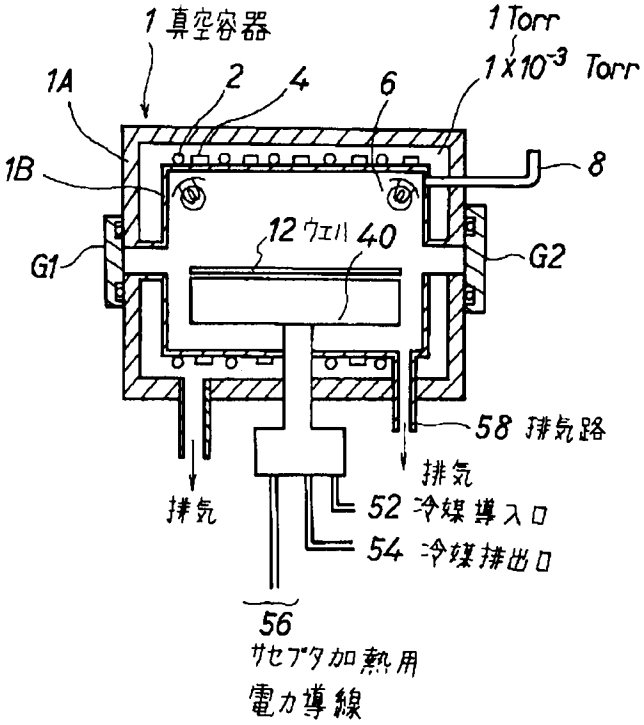
[Drawing 1]



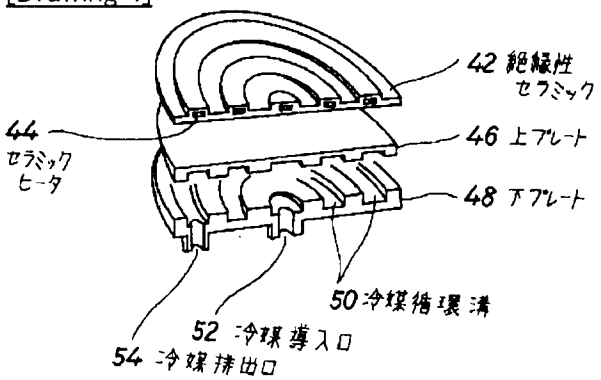
[Drawing 2]



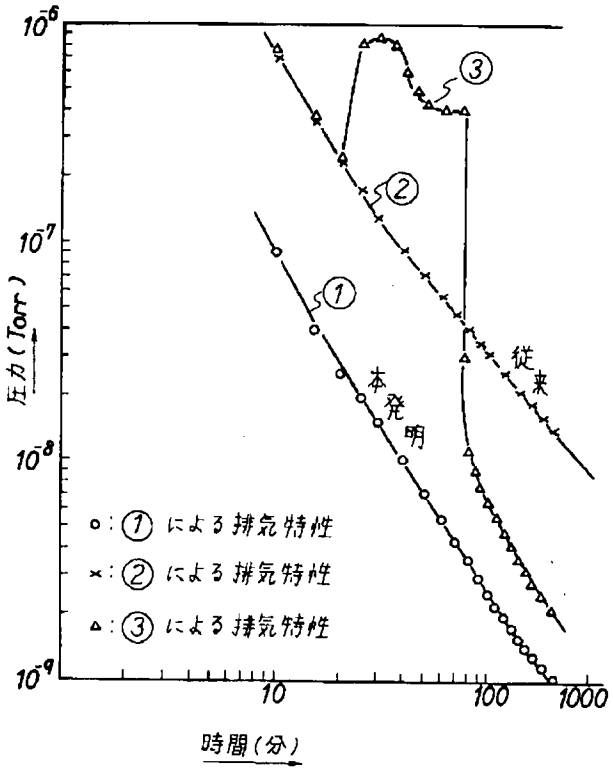
[Drawing 3]



[Drawing 4]



[Drawing 5]



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	21/205		7454－4M		
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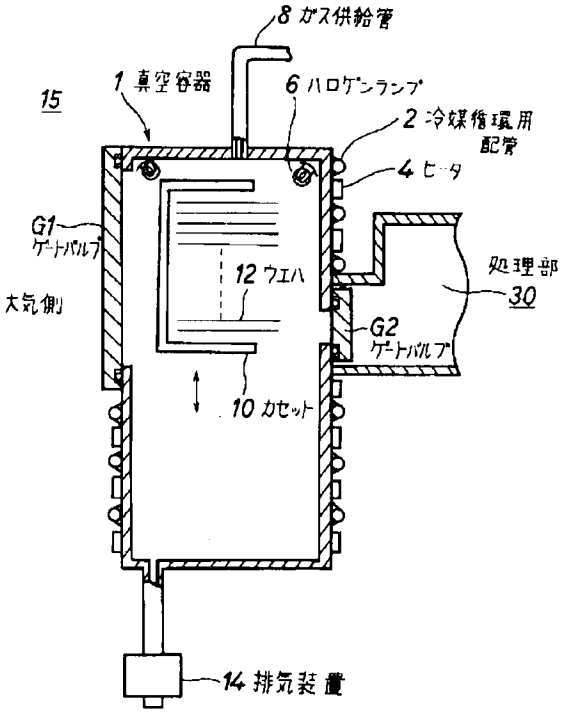
(54)【発明の名称】　排気方法

(57)【要約】　(修正有)

【目的】　気密容器付着物を除去し大気に解放される気密容器の排気を短時間で実行できる排気方法を提供する。

【構成】　開閉扉を開き気密容器を大気に解放する以前に気密容器壁を所定の温度に加熱し、大気解放中および開閉扉を閉じて気密容器内を真空排気中の所定時間、気密容器を所定の加熱温度に維持し、次に所定の温度に冷却する。他の方法は気密容器を長時間大気に解放後、排気操作開始前より少なくとも気密容器を所定の温度に加熱し、開閉扉を閉じて気密容器内を排気中の所定時間、気密容器を所定の加熱温度に維持し、次に所定の温度に冷却する。また、その他の方法は、気密容器を大気に解放中、気密容器を所定の温度に加熱し、開閉扉を閉じて気密容器内を排気中の所定時間所定の加熱温度に維持し、次に所定の温度に冷却する。



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【特許請求の範囲】

【請求項１】　開閉扉を開き気密容器を大気に少なくとも解放する以前に気密容器壁を所定の温度に加熱する工程と、気密容器を大気解放中および上記開閉扉を閉じて気密容器内を真空排気中の所定時間、少なくとも上記気密容器を所定の加熱温度に維持する工程と、次に上記気密容器を所定の温度に冷却する工程とからなることを特徴とする排気方法。

【請求項２】　気密容器を長時間大気に解放後、排気するに際し、排気操作開始前より少なくとも気密容器を所定の温度に加熱する工程と、開閉扉を閉じて気密容器内を排気中の所定時間、少なくとも気密容器を所定の加熱温度に維持する工程と、次に気密容器を所定の温度に冷却する工程とからなることを特徴とする排気方法。

【請求項３】　気密容器を大気に解放中、少なくとも気密容器を所定の温度に加熱する工程と、開閉扉を閉じて気密容器内を排気中の所定時間、少なくとも気密容器を所定の加熱温度に維持する工程と、次に気密容器を所定の温度に冷却する工程とからなることを特徴とする排気方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、排気方法に関する。

【０００２】

【従来の技術】従来、半導体ウェハ製造工程においては、ＣＶＤ装置、エピタキシャル装置、酸化膜形成装置、拡散装置等の成膜装置やイオン注入装置、ドライ・エッチング装置およびスパッター装置等、被処理体たとえば半導体ウェハを真空状態にしての処理、たとえば成膜やイオン注入等を行う装置が数多く用いられている。これらの真空処理装置は半導体ウェハを多数枚一度に処理するバッチ式や一枚毎に処理する枚葉式がある。また真空容器はステンレスまたはアルミ合金により製作されており、排気装置としてターボ分子ポンプやロータリーポンプを用いて、大気圧から排気を行っている。

【０００３】真空容器を大気圧に解放した状態から容器を密閉し排気を行う場合、高真空度を得るために排気開始後、所定の圧力になってから真空容器を一定時間ベーキングと称される高温、たとえばアルミ合金からなる容器では 140℃に加熱脱ガス処理を行う方法が行われている。また真空容器内部を真空状態から大気圧に戻す場合には乾燥窒素ガスや乾燥空気を容器に導入しその気体雰囲気で容器が満たされるようにしたり、容器の内部に挿入される試料等の交換で容器の一部を解放する場合には、乾燥窒素ガスや乾燥空気が解放口より放出する処置を実施し、大気中の水分が真空容器内に進入し難いように対策を施している。

【０００４】

【発明が解決しようとする課題】ベーキングを行って真空排気する技術では、ベーキングに長時間を要するため

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効率が悪いという改善点を有していた。また真空容器を大気に解放する際に乾燥窒素ガスを真空容器の解放口より放出する方法では、多量に乾燥窒素ガスを放出しても所定時間たとえば 1分間解放すると真空容器への大気の拡散あるいは流入や巻き込みは避けられず、大気の水分が真空容器内に付着してしまうという問題点があった。

【０００５】以上説明したような真空処理を行う半導体処理装置では、被処理体を真空容器に搬入する際、真空容器が大気圧に戻され、真空容器内壁が大気に接触した際、極めて短時間のうちに真空容器内壁表面への水分を主体とする気体分子の吸着が起こる。また室温状態で粗排気が行われた真空容器内では、真空容器内壁に付着した大気中の水分の凝縮・結露が発生する。

【０００６】初期の排気過程では、こうした容器内壁へ吸着あるいは付着した水分が徐々に蒸発し、主な残留気体として圧力の減少を妨げ、所定の真空度に達する所要時間を長くし、処理効率を低下させる要因になっている。特に外部雰囲気の湿度が高い場合や、真空容器が冷却されている場合には、結露の発生が著しく、真空引きに時間がかかっている。

【０００７】本発明は上記の欠点を改善するためになされたもので、気密容器付着物を除去し大気に解放される気密容器の排気を短時間で実行できる排気方法を提供するものである。

【０００８】

【課題を解決するための手段】第１の発明方法は、開閉扉を開き気密容器を大気に少なくとも解放する以前に気密容器壁を所定の温度に加熱する工程と、気密容器を大気解放中および上記開閉扉を閉じて気密容器内を真空排気中の所定時間、少なくとも上記気密容器を所定の加熱温度に維持する工程と、次に上記気密容器を所定の温度に冷却する工程とからなることを特徴とする排気方法。

【０００９】第２の発明方法は、気密容器を長時間大気に解放後、排気するに際し、排気操作開始前より少なくとも気密容器を所定の温度に加熱する工程と、開閉扉を閉じて気密容器内を排気中の所定時間、少なくとも気密容器を所定の加熱温度に維持する工程と、次に気密容器を所定の温度に冷却する工程とからなることを特徴とする排気方法。

【００１０】第３の発明方法は、気密容器を大気に解放中、少なくとも気密容器を所定の温度に加熱する工程と、開閉扉を閉じて気密容器内を排気中の所定時間、少なくとも気密容器を所定の加熱温度に維持する工程と、次に気密容器を所定の温度に冷却する工程とからなることを特徴とする排気方法。

【００１１】

【作用】この発明方法は、気密容器とこの気密容器に設けられる加熱手段および冷却手段と、前記気密容器に接続される排気手段とよりなっている真空装置において、気密容器が大気解放前および大気解放中、加熱手段によ

り気密容器内壁が水の気化温度以上に加熱されるので水分の気密容器内壁への付着は少ない。気密容器を真空排気して減圧の初期期間も上記と同様に加熱しているので水分の減圧に起因する凝縮・結露も少ない。また所定時間後、前記冷却手段により気密容器および被処理体を脱ガスの少ない温度に冷却することにより気密容器内は良好な高真空を得ることができる。

【００１２】

【実施例】実施例１

以下、本発明の排気方法をイオン注入装置のロードロック部に適用した一実施例について、まずイオン注入装置の構成を図面を参照して具体的に説明する。図１に示される気密容器たとえば真空容器１は、材質たとえばステンレススチールにより溶接構造とされた立方たとえば縦、横、高さ約25×25×50cmのもので、容器外周囲には冷却手段としてたとえば外直径 6mm位の銅製パイプからなる冷媒循環用配管２が螺旋状に巻回され、この配管２は熱伝導をよくするため上記真空容器１に密着たとえばロウ付けされ、上記配管２の両端は図示しない冷媒温度調整用装置たとえばチラー等に接続され、冷媒が循環供給可能な如く構成されている。また上記真空容器の加熱手段としてたとえばシーズヒータからなる発熱部であるヒータ４が螺旋状の上記冷媒循環用配管２と交互に上記真空容器１に密着して螺旋状に巻回され、外部の図示しない加熱のための電力供給制御装置に接続されている。また上記真空容器１の内部には被処理体たとえば半導体ウェハの加熱手段としての、たとえばハロゲンランプ６が設けられている。

【００１３】上記真空容器１のたとえば対向する両側面にはゲートバルブＧ１、Ｇ２が被処理体たとえば半導体ウェハを搬出入するため設置されている。

【００１４】また上記真空容器１内の上部には図示しないガス供給源からたとえば窒素ガスを供給するガス供給管８が設けられている。

【００１５】また前記真空容器１の底部には真空容器１を排気するため、たとえばロータリポンプで能力 250リットル／分およびたとえばターボ分子ポンプで能力 300リットル／秒によって構成された排気装置１４が接続され、真空度たとえば10^{-6}Torrから10^{-9}Torrに減圧することが可能の如き構成で、ロードロック部１５が形成されている。

【００１６】図２はイオン注入装置の全体構成を示す説明図である。すなわち真空容器内にイオン源２２、質量分析器２４、およびビーム整形器２６等がイオン通路に順次設けられ、図示しない真空排気手段により真空状態に保持される如くイオン発生部２０が構成されている。このイオン発生部２０と同一真空雰囲気になるように結合された処理部３０には、被処理体たとえば複数枚の半導体ウェハを保持し予め定められた速度で回転する回転テーブル２８と、この回転テーブル２８に被処理体を予め定められたプログラムで自動的に搬入搬出する搬送アーム３２を備えたロボットが設けられている。

【００１７】上記容器１外に設けられ処理前の被処理体を複数枚収容したカセット３６、たとえばウェハキャリアを上記真空容器２内に予め定められたプログラムで自動的に搬入搬出する搬送機構３４が設けられている。以上の如くイオン注入装置は構成されている。

【００１８】次に、上記装置の排気方法の一例について述べる。

【００１９】真空容器１内に複数枚の処理済み被処理体たとえば半導体ウェハが収納されたカセット１０が載置されており、上記半導体ウェハをカセット１０と共に搬出する場合について以下説明する。大気中の水分が真空容器１の内壁に付着することを防ぐため、真空状態でヒータ４に電流を流すことにより真空容器１内を所定時間たとえば 5分間、所定の温度たとえば 140℃に加熱する。その後、真空容器１内にガス供給管８から窒素ガスを大気圧になるまで導入し大気圧になった後、上記カセット１０を搬出するため、大気側ゲートバルブＧ１を開く。次に搬送機構３４を駆動させることによって真空容器１内の処理済みウェハの入ったカセット１０を搬出し、処理前の半導体ウェハの入ったカセット３６を真空容器１内に搬入する。すなわちカセット１０の入れ替えを行う。その後、大気側のゲートバルブＧ１を閉じ、真空容器１内を排気装置２０により所定の真空度まで排気する。この排気処理と同時に、大気に露出されたことにより真空容器１の内壁面上など大気中で付着した水分を速やかに蒸発せしめ、排気処理を促進するために被処理体である半導体ウェハは真空容器１の外周に設けたヒータ４および真空容器１内に設けたハロゲンランプ６を動作させることにより所定の温度たとえば 140℃に上記１壁を加熱し、所定の時間たとえば 5分間加熱状態を保持する。その後、冷却循環用配管２に冷却媒体を循環させ速度たとえば50℃/ 分から 100℃／分で所定の温度たとえば20℃に冷却する。

【００２０】次に、真空容器１内が所定の真空度に達した後、処理部３０側のゲートバルブＧ２を開いて真空容器１内のウェハを搬送アーム３２により回転テーブル２８上の所定位置に搬送する。回転テーブル２８の周縁予め定められた位置にウェハが所定枚数載置されると、当該回転テーブル２８が垂直に起立し、イオン発生部２０からのイオンが加速されて各ウェハに走査的にイオン注入処理を行う。

【００２１】上記した大気圧から排気処理を行った３つの例について経過時間と圧力の関係を図５に示す。図５において変化曲線①は本発明の実施例方法で真空容器１を排気処理したもので真空状態から大気圧に戻し、真空排気開始後 5分間真空容器１内を 140℃の加熱状態を保ち、その後、冷却を行い真空容器１を室温に戻した場合の圧力変化の特性を示す。変化曲線②は従来の排気方法

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で真空容器１を真空状態から大気圧に戻した後、真空排気を開始するまでの間、常に真空容器１を室温である20℃に保った場合の圧力変化の特性を示す。変化曲線❸は真空容器１を真空排気開始後20分間は変化曲線❷と同様に室温状態を保ち、その後、真空容器１を 140℃で 5分間保持した後、冷却を行った場合の圧力変化の特性を示す。

【００２２】図５の変化曲線❷から明らかなように、従来の方法では大気圧から10^{-7}Torrの真空度に到達するのに約40分、10^{-8}Torrに達するには約1000分かかっているが、本発明では変化曲線❶からも明らかなように、各々の真空度到達時間は約 9分および約40分と従来の方法に比べて1/4 から1/25に排気処理時間が短縮されている。

上記実施例装置において加熱手段、冷却手段としては真空容器１をカバーで覆い、このカバーの内に熱媒体たとえば熱風や冷却媒体たとえば液体窒素の蒸気を導入してもよい。また排気処理工程において真空容器１および被処理体を加熱して真空容器１の内壁面付着物を除去した後、ガス供給管８よりたとえば冷却された乾燥気体たとえば窒素や不活性ガスのアルゴンガスを真空容器１に所定量導入して前記真空容器１および被処理体を冷却してもよい。

【００２３】また真空容器１を長時間たとえば 1日以上室温状態で大気圧に放置しておいた場合にあっても、排気開始直前たとえば 5分前から排気開始後所定の時間たとえば 5分間加熱状態にして内壁面付着物を除去し、その後、真空容器１および被処理体を冷却することで上記と同様に排気処理時間の短縮効果がある。

【００２４】実施例２

本発明方法は上記実施例装置についてのみ使用できる方法ではなく、次に説明する第２の実施例装置についても使用できる方法である。

【００２５】本発明の真空排気方法装置を枚葉式ロードロック部に適用した一実施例について、図３を参照して具体的に説明する。真空容器内壁の加熱冷却に対して熱応答性を向上するために真空容器１は外真空容器１Ａと内真空容器１Ｂの二重構造にしている。外真空容器１Ａは主に大気の圧力を受け持つために機械構造的に丈夫に設計・製作してあり、その内側の真空度は内真空容器１Ｂの真空度との中間たとえば1Torr から 1×10^{-4}Torrになるように排気可能の如く構成されている。

【００２６】内真空容器１Ｂは外真空容器１Ａの内側に設けられる。この内真空容器１Ｂは熱伝導性が高くなるように設計・製作されており、その外周囲には実施例１と同様な加熱手段４と冷却手段２が設けられている。

【００２７】また前記内真空容器１Ｂの下部にはこの内真空容器１Ｂを排気するための排気路５８が外真空容器１Ａを貫通して設けられており、図示しない排気装置たとえばロータリポンプ能力 250リットル／分およびたとえばターボ分子ポンプ能力 300リットル／秒が接続され、真空たとえば10^{-6}Torrから10^{-9}Torrに減圧することが可能の如く構成されている。

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【００２８】前記真空容器の両側面にはゲートバルブＧ１、Ｇ２が被処理体たとえば半導体ウェハの搬出入のため設置されている。

【００２９】前記真空容器１Ｂには被処理体たとえば半導体ウェハ１２を載置する、たとえばセラミック基板よりなるサセプタ４０が設けられる。このサセプタ４０の断面構造を図４に示す。サセプタ４０は絶縁性セラミック４２およびこのセラミック４２内に埋設されたセラミックヒータ４４よりなる加熱ヒータ部と、これを保持し冷媒循環構造を有する上プレート４６、下プレート４８よりなるプレート部で構成される。このプレート部には冷媒導入口５２と排出口５４が設置され、図示しない冷媒温度制御用装置から送出された冷媒が冷媒導入口５２から入り、スパイラル状の冷媒循環溝５０を循環し、サセプタ４０を冷却した後、冷媒排出口５４から排出する。

【００３０】本発明方法を説明する実施例２の真空装置は以上のように構成されており、真空排気方法は前記実施例１の説明と同様なため説明は省略する。

【００３１】上記実施例においてサセプタの加熱ヒータ部は必ずしもセラミック材料である必要はなく、金属プレートヘシースヒータ等を埋め込んだ構造でもよい。あるいは内部に設置した加熱手段であるハロゲンランプ６によって加熱してもよい。

【００３２】また水の沸点は真空度1Torr の時59℃に低下するので減圧中の前記真空容器１および被処理体の加熱温度はたとえば1Torrの時59℃以上であれば良好に作用する。

【００３３】上記の実施例は本発明方法の一実施例の説明であって、必ずしもイオン注入装置に適用するに限らず酸化や拡散等の熱処理装置およびＣＶＤ装置、エッチング装置等の真空容器、低圧容器またはそれらのロードロック室等気密容器の排気方法であればいずれに適用することも可能である。

【００３４】

【発明の効果】以上説明したように、本発明の排気方法によれば大気解放した気密容器も、少なくとも容器内壁面に付着した付着物も短時間で排気することが可能となる。

【図面の簡単な説明】

【図１】本発明方法を説明するための実施例１に係わるロードロックの縦断面図。

【図２】実施例１を適用したイオン注入装置の概略説明図。

【図３】本発明方法の実施例２に係わるロードロックの断面図。

【図４】図３に用いたサセプタの構造説明図。

【図５】図１に用いた真空容器の排気特性図。

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【符号の説明】
１……真空装置
２……冷媒循環用パイプ
４……ヒータ
６……ハロゲンランプ
８……ガス供給管
１０……カセット
１２……半導体ウェハ
１４……排気装置
２０……イオン発生部
２２……イオン源
２４……質量分析器
２６……ビーム整形器
２８……回転テーブル
３０……処理部
３２……搬送アーム

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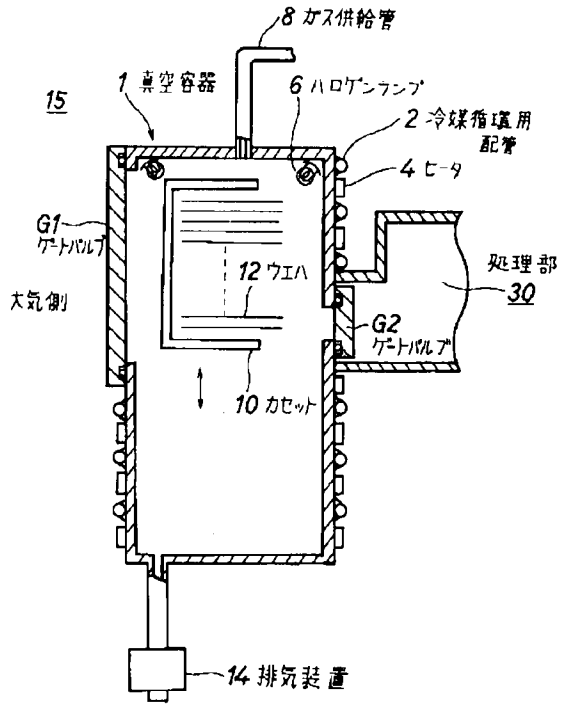
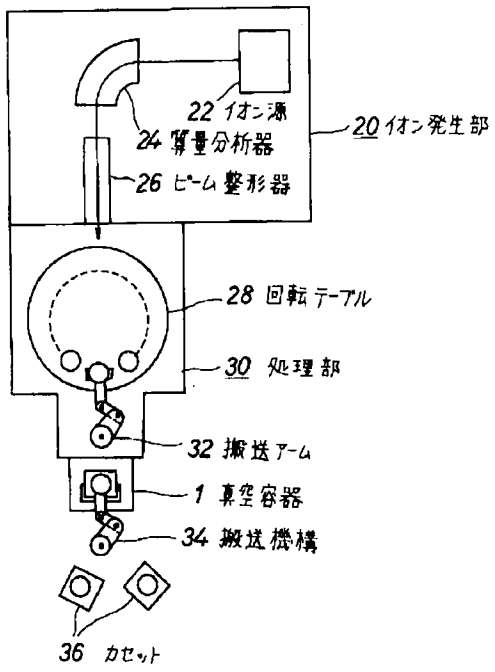
＊３４……搬送機構
３６……カセット
４０……サセプタ
４２……絶縁性セラミック
４４……セラミックヒータ
４６……上プレート
４８……下プレート
５０……冷媒循環溝
５２……冷媒導入口
５４……冷媒排出口
５６……ザセプタ加熱用電力導線
５８……排気路
Ｇ１……大気側ゲートバルブ
Ｇ２……処理部側ゲートバルブ
１Ａ……外真空容器
＊　１Ｂ……内真空容器

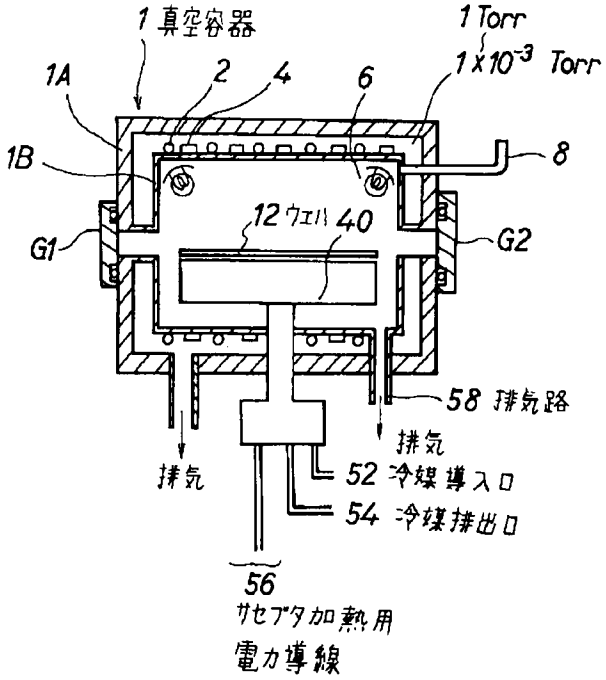
【図１】



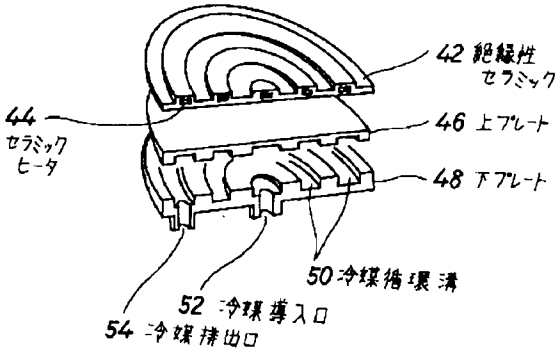
【図２】



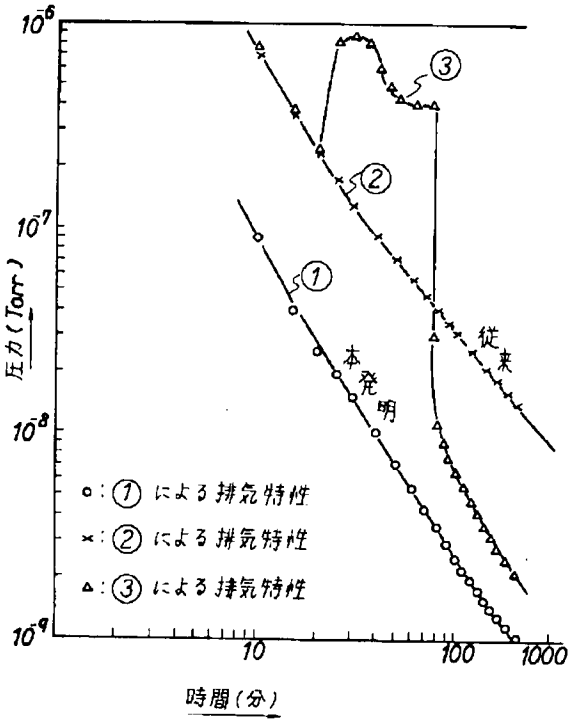
【図３】


1 真空容器
1 Torr
1×10⁻³ Torr
1A
2
4
6
8
1B
12 ウエハ
40
G1
G2
58 排気路
排気
排気
52 冷媒導入口
54 冷媒排出口
56
サセプタ加熱用
電力導線

【図４】


42 絶縁性
セラミック
44
セラミック
ヒータ
46 上プレート
48 下プレート
50 冷媒循環溝
52 冷媒導入口
54 冷媒排出口

【図５】


10⁻⁶
10⁻⁷
10⁻⁸
10⁻⁹
圧力(Torr)
③
②
①
従来
本発明
○：① による排気特性
×：② による排気特性
△：③ による排気特性
10
100
1000
時間(分)

フロントページの続き

(51)Int.Cl.'	識別記号	庁内整理番号	FI	技術表示箇所
H01L 21/31		B 8518－4M		